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U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY.—BULLETIN 104.

A. D. MELVIN, CHIEF OF BUREAU.

MEDICAL MILK COMMISSIONS AND THE PRODUCTION OF CERTIFIED MILK IN THE UNITED STATES.

BY

CLARENCE B. LANE,

Assistant Chief of the Dairy Division.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Animal Industry,
Washington, D. C., January 2, 1908.

Sir: I have the honor to transmit, and to recommend for publication as Bulletin 104 of this Bureau, the accompanying manuscript entitled "Medical Milk Commissions and the Production of Certified Milk in the United States," by Clarence B. Lane, assistant chief of the Dairy Division of this Bureau. The writer gives a history of the movement which has brought about the organization of milk commissions in a number of cities throughout the country, and describes the methods used in the production of what is termed "certified milk." The work of milk commissions and the production of certified milk not only result in supplying a high-grade product for special uses, but are believed to be important factors in improving the quality of the general milk supply.

Respectfully,

A. D. Melvin,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

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MEDICAL MILK COMMISSIONS AND THE PRODUCTION OF CERTIFIED MILK IN THE UNITED STATES.

I.—THE WORK OF MILK COMMISSIONS.

The organization of milk commissions in this country was an important step toward the improvement of the quality of milk. While the number of commissions is very limited and the milk produced under their supervision amounts to only a fraction of 1 per cent of the 10,000,000,000 quarts or more of market milk annually consumed, the great value of certified milk to invalids and its influence in reducing the mortality among infants and children are beyond estimation. Further, the work of milk commissions has had no little influence in improving the general milk supply of cities where such commissions exist, by setting a higher standard of quality and by creating public sentiment in favor of pure milk.

THE FIRST COMMISSION: ITS ORGANIZATION AND OBJECTS.

The beginning of this movement dates back to 1890, when the Medical Society of New Jersey made an effort to improve the milk production in that State. A committee was appointed to make an investigation of the milk supply as far as it affected the public health. After two years' work this committee submitted a report condemning many of the methods employed in the production and handling of milk and advising an appeal to the State for a strict scientific supervision of all the dairies within its limits. The appeal was made, but failed. While the need was admitted, the authorities pleaded lack of funds for making the changes suggested.

This effort having met with defeat, another line of work was resorted to. The chairman, a Newark physician, presented a plan in 1892 to the Practitioners' Club of that city whereby physicians might themselves supervise the production of milk and thus be perfectly sure of its purity. The requirements for the production of certified milk were given with the utmost detail. It was recommended that a milk commission be formed by physicians who should certify to the milk over their names provided the requirements were fulfilled. This plan was indorsed by the Practitioners' Club, and a search was begun for a

dairy with equipment suited to such rigid regulations. A dairy was found which had already set such a high standard that the methods used could readily be accommodated to the requirements of the medical commission.

Having secured a dairyman who was ready to bind himself by contract to conduct his dairy in accordance with the requirements, physicians from Newark, Orange, and Montclair were chosen to make up the first milk commission, which was organized April 13, 1893, and the production of what is known as "certified milk" was begun. This commission was named "The Medical Milk Commission of Essex County, New Jersey." Since this was organized about 25 others have been or are now being formed in various cities on a similar plan. A description of the first will therefore serve to give a general idea of milk commissions and their work.

OBJECTS OF THE COMMISSION.

The objects and requirements of the commission were stated as follows:

> The objects of this commission are to establish correct clinical standards of purity for cow's milk; to become responsible for a periodical inspection of the dairies under its patronage; provide for chemical and bacteriological examinations of the product, and the frequent scrutiny of the stock by competent veterinarians; to promote only professional and public interests.
>
> The following are three general requirements or standards for the milk: (1) An absence of large numbers of micro-organisms, and the entire freedom of the milk from pathogenic varieties; (2) unvarying resistance to early fermentative changes in the milk, so that it may be kept under ordinary conditions without extraordinary care; (3) a constant nutritive value of known chemical composition, and a uniform relation between the percentage of fats, proteids, and carbohydrates.

THREEFOLD EXAMINATION BY EXPERTS.

A chemist and a bacteriologist examine samples of the milk, which they obtain themselves, twice each month, and report their findings to the commission. A veterinarian examines the cows twice a month and makes report. Representatives of the commission in person make a monthly inspection of the dairy and report to the others.

The veterinarian must show the milch cows to be in perfect health. The chemist must show the milk to contain the required amount of solids and to be free from all foreign matter. The bacteriologist must show the absence of all disease-producing bacteria, and a minimum of bacteria of all sorts. Only in case all these reports are satisfactory does the commission certify to the milk.

ORIGIN AND MEANING OF THE TERM "CERTIFIED MILK."

The term "Certified Milk" originated with the member of the commission who formulated the plan. At the instance of the com-

mission the word "Certified" was registered by Mr. Francisco in the United States Patent Office on October 16, 1904, under registery No. 25,368, the object being to protect it from being degraded by dairymen not under contract with a medical commission. It was distinctly understood, however, that the use of the term should be allowed without question when employed by medical milk commissions organized to influence dairy work for clinical purposes. Certified milk, then, in the strict sense of the term, is milk produced under a legal contract between a medical milk commission and a dairyman and which conforms to the requirements. It may be said further that milk entitled to be certified is clean and wholesome, and is obtained from healthy cows which are kept in sanitary quarters, fed wholesome feed, and given pure water. It is drawn from clean cows by clean, healthy attendants into clean receptacles and in a clean atmosphere. It is handled in a clean manner, cooled quickly, put into sterile vessels, placed in cold storage, and iced in transportation when necessary.

CONTROL OF DAIRIES.

Some commissions—particularly such as have under their supervision only one dairyman who both produces and distributes certified milk—enter into a binding contract with the dairymen. This contract contains a more or less complete and detailed statement of the conditions under which the certified milk must be produced and marketed; specifies standards for composition and bacterial content of the milk; provides for inspection of premises, examination of cows, and collection and analysis of milk samples; and includes provisions under which the contract may be terminated by either party entering into it.

Many commissions prefer not to have any contract with their producers and claim that it is superfluous and unnecessary. The producers understand well that if their milk does not come up to the requirements they can not sell it. However, in cases where there are contracts commissions are not at all hasty in severing relations with a producer when his milk falls below requirements, but make more frequent inspections and lend every effort at such inspections to help the dairyman out of his trouble. In this way, when a producer does have trouble he often writes to know when the commission can send a representative to help him out of his difficulty. The efforts of such commissions are therefore to help and cooperate closely with the producer. Some commissions feel safer in the work without a lengthy binding contract. This plan allows a certain latitude for meeting conditions as they arise, and the latter vary greatly at different farms even though the dairymen all produce milk well within the requirements and standards. Where there is no contract with the dairyman it is customary for the commissions to send a

circular giving information concerning the production, standards, and general requirements of certified milk. A good example of such a circular follows:

REQUIREMENTS OF THE MILK COMMISSION OF THE MEDICAL SOCIETY OF THE COUNTY OF NEW YORK FOR CERTIFIED MILK.

* * * * * * *

The commission has fixed upon a maximum of 30,000 germs of all kinds per cubic centimeter of milk, which must not be exceeded to obtain the indorsement of the commission. This standard must be attained solely by measures directed toward scrupulous cleanliness, proper cooling, and prompt delivery.

The milk certified by the commission must contain not less than 4 per cent of butter-fat on the average, and have all other characteristics of pure, wholesome milk.

Milk must not be sold as certified more than twenty-four hours after its arrival in New York City.

Dealers.—In order that dealers who incur the expense and take the precautions necessary to furnish a truly clean and wholesome milk may have some suitable means of bringing these facts before the public, the commission offers them the right to use caps on their milk jars stamped with the words: "Certified by the Milk Commission of the Medical Society of the County of New York." The dealers are given the right to use these certificates when their milk is obtained under the conditions required by the commission and conforms to its standards.

In accordance with a law passed at the last legislature, the word "Certified" may be used on the cap only when accompanied by the name of the society which certifies it.

The tinned sealed cap authorized by the commission must be used on all the certified milk passing through the hands of dealers selling milk other than the certified. These caps are sent by the makers only to the farm where the milk is bottled.

The name of the farm from which the milk comes must appear on either the paper cap or the tin cap.

Each bottle of milk must be dated on the date of bottling.

The milk commission looks to the dealers for its fee.

The dealer is expected to send a bottle of milk each week to the research laboratory of the department of health, taken at random from the day's supply for examination by experts for the commission.

The dealers are to furnish deep, covered boxes for the certified milk.

The required conditions at the farm are as follows:

1. *The barnyard.*—The barnyard should be free from manure and well drained, so that it may not harbor stagnant water. The manure which collects each day should not be piled close to the barn, but should be taken several hundred feet away. If these rules are observed not only will the barnyard be free from objectionable smell, which is an injury to the milk, but the number of flies in summer will be considerably diminished. These flies are an element of danger, for they are fond of both filth and milk and are liable to get into the milk after having soiled their bodies and legs in recently visited filth, thus carrying it into the milk. Flies also irritate cows, and by making them nervous reduce the amount of their milk.

2. *The stable.*—In the stable the principles of cleanliness must be strictly observed. The room in which the cows are milked should have no storage loft above it; where this is not feasible the floor of the loft should be tight, to prevent the sifting of dust into the stable beneath.

The stables should be well ventilated, lighted, and drained, and should have tight floors, preferably of cement, never of dirt.

They should be whitewashed inside at least twice a year, unless the walls are painted or of smooth cement finish which can be washed frequently.

The air should always be fresh and without bad odor. A sufficient number of lanterns should be provided to enable the necessary work to be properly done during the dark hours. The manure should be removed twice daily, except when the cows are outside in the fields the entire time between the morning and afternoon milkings. The manure gutter must be kept in a sanitary condition. All sweeping must be finished before the grooming of the cows begins, so that the air may be free from dust at the time of milking.

There should be an adequate supply of warm and cold water, and the necessary wash basins, soap, and towels.

3. Water supply.—The whole premises used for dairy purposes, as well as the barn, must have a supply of water absolutely free from any danger of pollution with animal matter and sufficiently abundant for all purposes and easy of access.

4. The cows:—No cows will be allowed in the herd furnishing certified milk except those which have successfully passed a tuberculin test. All must be tested at least once a year, by a veterinarian approved by the milk commission. Any animal suspected of being in bad health must be promptly removed from the herd and her milk rejected. Do not allow the cows to be excited by hard driving, abuse, loud talking, or any unnecessary disturbance.

Feed.—Do not allow any strongly flavored food, like garlic, to be eaten by the cows.

When ensilage is fed, it must be given in only one feeding daily, and that after the morning milking, and the full ration shall consist of not more than 20 pounds daily for the average-sized cow. When fed in the fall, small amounts must be given and the increase to the full ration must be gradual.

Corn stalks must not be fed until after the corn has blossomed, and the first feedings must be in small amounts and the increase must be gradual.

If fed otherwise, ensilage and corn stalks are liable to cause the milk to affect children seriously.

Cleaning.—Groom the entire body of the cow daily. Before each milking wash the udder with a cloth used only for the udders, and wipe it with a clean, dry towel. Never leave the udder wet, and be sure that the water and towel used are clean. The tail should be kept clean by frequent washing. If the hair on the flanks, tail, and udder is clipped close and the brush on the tail is cut short, it will be much easier to keep the cow clean.

The cows must be kept standing after the cleaning until the milking is finished. This may be done by a chain or a rope under the neck.

5. The milkers.—The milker must be personally clean. He should neither have nor come in contact with any contagious disease while employed in handling the milk. In case of any illness in the person or family of any employee in the dairy, such employee must absent himself from the dairy until a physician certifies that it is safe for him to return.

In order that the milk commission may be informed as to the health of the employees at the certified farms, the commission has had postal cards printed to be supplied to the farms, and to be filled out and returned each week by the owner, manager, or physician of the farm, certifying that none are handling the milk who are in contact with any contagious disease.

Before milking, the hands should be washed in warm water with soap and nail brush and well dried with a clean towel. On no account should the hands be wet during milking.

The milkers should have light-colored, washable suits, including caps, and not less than two clean suits weekly. The garments should be kept in a clean place, protected from dust, when not in use.

Iron milking stools are recommended, and they should be kept clean.

Milkers should do their work quietly and at the same hour morning and evening. Jerking the teat increases materially the bacterial contamination of the milk and should be forbidden.

6. Helpers other than milkers.—All persons engaged in the stable and dairy should be reliable and intelligent. Children under 12 should not be allowed in the stable or dairy during milking, since in their ignorance they may do harm, and from their liability to contagious diseases they are more apt than older persons to transmit them through the milk.

7. Small animals.—Cats and dogs must be excluded from the stables during the time of milking.

8. The milk.—All milk from cows sixty days before and ten days after calving must be rejected.

The first few streams from each teat should be discarded in order to free the milk ducts from the milk that has remained in them for some time and in which the bacteria are sure to have multiplied greatly. If any part of the milk is bloody or stringy or unnatural in appearance, the whole quantity yielded by that animal must be rejected. If any accident occurs in which a pail becomes dirty, or the milk in a pail becomes dirty, do not try to remove the dirt by straining, but put aside the pail, and do not use the milk for bottling, and use a clean pail.

Remove the milk from each cow from the stable immediately after it is obtained to a clean room and strain through a sterilized strainer of cheese cloth and absorbent cotton.

The rapid cooling is a matter of great importance. The milk should be cooled to 45° F. within an hour and not allowed to rise above that as long as it is in the hands of producer or dealer. In order to assist in the rapid cooling, the bottles should be cold before the milk is put into them.

Aeration of milk beyond that obtained in milking is unnecessary.

9. Utensils.—All utensils should be as simple in construction as possible, and so made that they may be thoroughly sterilized before each using.

Coolers, if used, should be sterilized in a closed sterilizer, unless a very high temperature can be obtained by the steam sent through them.

Bottling machines should be made entirely of metal with no rubber about them, and should be sterilized in the closed sterilizer before each milking, or bottling.

If cans are used, all should have smoothly soldered joints, with no places to collect the dirt.

Pails should have openings not exceeding 8 inches in diameter, and may be either straight pails, or the usual shape with the top protected by a hood.

Bottles should be of the kind known as "common sense," and capped with a sterilized paraffined paper disk, and the caps authorized by the commission.

All dairy utensils, including the bottles, must be thoroughly cleansed and sterilized. This can be done by first thoroughly rinsing in warm water, then washing with a brush and soap, or other alkaline cleansing material, and hot water, and thoroughly rinsing. After this cleansing they should be sterilized by boiling, or in a closed sterilizer with steam, and then kept inverted in a place free from dust.

10. The dairy.—The room or rooms where the utensils are washed and sterilized and the milk bottled should be at a distance from the house, so as to lessen the danger of transmitting through the milk any disease which may occur in the house.

The bottling room, where the milk is exposed, should be so situated that the doors may be entirely closed during the bottling and not opened to admit the milk nor to take out the filled bottles.

The empty cases should not be allowed to enter the bottling room nor should the washing of any utensils be allowed in the room.

The workers in the dairy should wear white washable suits, including cap, when handling the milk.

Bottles must be capped, as soon as possible after filling, with the sterilized disks.

11. Examination of the milk, and dairy inspection.—In order that the dealer and the commission may be kept informed of the character of the milk, specimens taken at random will be examined weekly by experts for the commission at the laboratory of the department of health, the use of the laboratories having been given for that purpose.

The commission reserves to itself the right to make inspections of certified farms at any time and to take specimens of the milk for examination and to impose fines for repeated or deliberate violations of the requirements of the commission.

The commission also reserves the right to change its standards in any reasonable manner upon due notice being given to the dealers.

The expenses of making the regular milk reports and the inspections are borne by the dealers. The treasurer of the Medical Society of the County of New York will send bills the first of each month for the certification for the previous month.

The monthly charges, which are intended to cover all expenses, are as follows:

Where the output of a farm is handled by one dealer:

For daily output of less than 100 quarts	$8
For daily output of from 100 to 200 quarts	10
For daily output of from 200 to 500 quarts	12
For daily output of over 500 quarts	15

Where the output of a farm is sent to several dealers, each dealer pays:

For daily output of less than 100 quarts	6
For daily output of from 100 to 200 quarts	8
For daily output of from 200 to 500 quarts	10
For daily output of over 500 quarts	12

The names of the dealers, with their addresses, are printed on cards and inclosed with the monthly bulletin of the medical society, which is sent to about 1,700 physicians. For this $1 is charged each month.

FORM FOR DAIRYMAN'S APPLICATION FOR CERTIFICATION OF MILK AND CREAM.

Application of dairyman.

Date.....190....

I hereby make application to the Jackson County Medical Society for the certification of milk and cream to be sold by me in the city of Jackson. In consideration of such certification I agree to observe such rules and regulations as may from time to time be enacted by the committee appointed by the Jackson County Medical Society. I also agree to allow such committee or their proper representatives, whenever they request it, to remove from any milk wagon or from the dairy a reasonable sample of milk or cream. It is understood that failure to comply with the rules of the committee will result in the suspension or withdrawal of my certification.

Name of dairy.....

License No..... Residence.....

Name of former owner.....

Number of quarts of milk and cream per day.....

If obtained from outside sources other than dairy owned by applicant, give names and addresses.....

Signature of applicant.....

To Dr.....Secretary,

Colony Building, Jackson, Mich.

FORM FOR MILK COMMISSION'S CERTIFICATE TO THE DAIRYMAN.

The Milk Commission of the Academy of Medicine, Cincinnati, Ohio.

Date.....

The veterinary inspector of the commission has examined the dairy of Mr.....
.....and reports it to be well kept and clean, and the cows to be in healthy condition.

The bacteriologist reports that the milk does not contain germs beyond the limits of the standards of the commission for.....milk.

The chemist reports that the milk is of standard richness, and that he has discovered in it no impurities, coloring matters, chemical preservatives, or harmful substances.

The commission certifies to these statements of examiners. It is understood and agreed to by the said.....
that this certificate is not good for more than.....
from date, before which time another examination will be made.

Signed.....

METHODS AND WORK OF THE VARIOUS MILK COMMISSIONS.

As previously stated, the first milk commission was organized April 13, 1893, and it was not until five years later (1898) that the second was formed. After 1899 the movement spread more rapidly and commissions were organized as follows: One in 1900, one in 1901, five in 1902, two in 1903, three in 1904, one in 1905, five in 1906, and thirteen organized or in process of organizing in 1907. The subject is being agitated in several cities at the present time and it is quite probable that the number of commissions will be considerably increased in the near future. In order to obtain information relative to the work of the commissions and their methods of operation a list of queries was sent to each. The answers received from the commissions have been summarized in Table 1, page 15.

TABLE 1.—*Facts relating to the work of milk commissions.*[a]

Name of commission.	When organized.	Standards established.			Difficulty in keeping milk up to standard.	Number of dairies.	Milk handled daily.	Price per quart of certified milk.	Price per quart of ordinary market milk.
		Maximum bacteria per cubic centimeter.	Butter fat.	Solids not fat.					
			Per cent.	*Per cent.*			*Quarts.*	*Cents.*	*Cents.*
Essex County (N. J.) Medical Milk Commission	1893	(b)	4.5	9.0	No	1	2,500	12	8
Milk Commission of Hartford County Medical Society, Hartford, Conn.[c]	1898								
Philadelphia Pediatric Society Milk Commission	1899	10,000	[d] 3.5–5.5	(b)	No.	4	2,450	12–16	8–10
Milk Commission of the Medical Society of the County of New York (N. Y.)	1900	30,000	4.0	(b)	Little	20	9,373	12–20	8
Milk Commission of the Rochester (N. Y.) Academy of Science	1901	10,000	3.5	9.0	Little	1	230	10	6
Milk Commission of the Medical Society of the County of Kings (N. Y.)	1902	[e] 20,000 10,000	4.0	(b)	Some	8	2,810	12	6–8
Milk Commission of the Elmira (N. Y.) Academy of Science	1902	10,000	3.5–4.5	(f)	No.	1	120	8	5
Milk Commission of the Medical Society of the County of Albany (N. Y.)	1902	[e] 10,000 5,000	3.5–4.5		No.	1	225	12	6
Medical Society of the District of Columbia Milk Commission[c]	1902								
Milk Commission of the Hennepin County Medical Society (Minneapolis Minn.)	1902	10,000	3.5–4.5	8.5	No.			10	6
Milk Commission of the Milwaukee Medical Society	1903	10,000	3.75–4.5	8.0	No.	1	2,000	12	6
Milk Commission of the Children's Hospital of Chicago	1903	30,000	4.0	(b)		1	300	[g] 12	6
The St. Louis Pure-Milk Commission	1904	30,000	3.25–4.5	8.6	No.	2	336	15	7–8½
Milk Commission of the City of Cleveland	1904	10,000	4.0	(b)	Little	1	447	15	7
Oakland (Cal.) Home Club Milk Commission	1904	10,000	4.0	8.0	No.	1	600	12½	9
Milk Commission of Syracuse Academy of Medicine, Syracuse, N. Y.[c]	1905								
Milk Commission of the San Francisco County (Cal.) Medical Society	1906	20,000	3.5	(b)	No.	(h)	(h)	12½–13	10
Milk Commission of the Academy of Medicine (Cincinnati, Ohio)	1906	10,000	4.0	(b)	No.	1	400	14	6
Milk Commission of the Cambridge (Mass.) Medical Improvement Society	1906	10,000	3.7	9.3	Little	1	750	10	7–8
Jefferson County Medical Society Milk Commission (Louisville, Ky.)	1906	10,000	4.0	8.0	Little	3	632	10	7½
Commission of the Suffolk District Medical Society (Boston, Mass)	1906	10,000	3.5–4.5	(b)	Little		250	20	8–10
Milk Commission of the Academy of Medicine of Toledo (Ohio)	1907	10,000	4.0			1		12	6–8
Jackson County Medical Society Milk Commission (Jackson, Mich.)	1907	[e] 50,000 25,000	3.5		No.	2	430	8	7
Montgomery County Medical Milk Commission, Dayton, Ohio	1907	10,000	4.5		No.	1	250	12	7–9
Wayne County Medical Milk Commission, Detroit, Mich	(i)								
Summit County Medical Milk Commission, Akron, Ohio	(i)								
Kansas City Pure Milk Commission, Kansas City, Kans	(i)								
Rutland County Medical Milk Commission, Rutland, Vt	(i)								

[a] Data largely collected prior to January 1, 1907. Milk commissions are also in process of formation at New Orleans, La.; Pittsburg, Pa.; Jacksonville, Fla.; Colorado Springs, Colo.; Binghamton, N. Y., and Bethlehem, Pa.

[b] No standard established.

[c] Not active at the present time—1908.

[d] Milk sold as 4 per cent milk is allowed to vary from 3.5 to 4.5 per cent. That sold as 5 per cent milk is allowed to vary from 4.5 to 5.5 per cent.

[e] Higher limit for summer; lower for winter.

[f] Specific gravity 1.029 to 1.034; proteid 3.7 to 4.5; sugar 4 to 5 per cent.

[g] Sold for infant feeding at about half this price.

[h] Operations suspended at time of report owing to effects of earthquake and fire.

[i] Now organizing.

NUMBER OF CERTIFIED DAIRIES AND QUANTITY OF MILK PRODUCED.

The number of dairies producing milk for any one commission varies from 1 to 20. Eleven commissions have 1 each; three have 2; one has 3; one 4; and one 20. Four commissions have temporarily stopped certifying to milk, namely, Hartford, Minneapolis, San Francisco, and Washington. The least amount handled daily by any one commission is 120 quarts and the greatest amount 9,373 quarts. (See Table 1.) A few commissions certify to cream as well as milk. The reports from commissions show that there were 24,103 quarts of certified milk handled daily on January 1, 1907.

STANDARDS FOR CONDITION AND QUALITY OF MILK.

The standards for bacteria vary with the different commissions. Of the 20 reporting standards, 13 place the number at 10,000 per cubic centimeter, 1 at 20,000, and 3 at 30,000. One has a standard of 10,000 from October to April, and 20,000 from April to October. Another has a standard of 5,000 in winter and 10,000 in summer, and another a standard of 25,000 in winter and 50,000 in summer. The standard for cream in all cases where it is certified is 25,000 per cubic centimeter.

The standard required for fat in eight instances is a minimum of 4 per cent; in three instances, 3.5; in two, 4.5; and in one, 3.7+. Four allow a range of 3.5 to 4.5, one a range of 3.25 to 4.50, and one 3.75 to 4.50. One puts out a special milk containing a higher percentage of fat, which must keep within the limits of 4.50 and 5.50 per cent. One commission specifies that the cream must not vary more than 2 per cent from the guaranty. Only eight commissions report standards for solids not fat. These range from 8 to 9.3 per cent.

LIVING UP TO THE STANDARD.

Twelve commissions report that their dairies have no difficulty in producing milk that is up to the required standards. Five report a little difficulty, and one states that there was no trouble with the bacteria count, but that it took several months to reach the fat standard, which was 4 per cent.

INSPECTION OF DAIRY AND PRODUCT.

The answers from the various commissions relative to inspections show considerable variation. In some instances the inspections are made by members of the commission and in others paid inspectors are employed to do the work. As a rule inspections of the dairy are made monthly either by a veterinarian or a member of the commission, or both, and in some instances inspections are made every two weeks. The tuberculin test is usually applied annually, but in some cases this is done every six months. Chemical and bacteriological

examinations range all the way from once a week to once in two months; in most instances, however, it is the practice to make tests every two weeks or oftener.

HEALTH OF EMPLOYEES.

The employees in certified-milk plants are required to be clean in habits and appearance and are not admitted to the stables or dairy if not in good health. Some commissions require that employees be regularly examined by a physician and given certificates of health. In some certified plants attendants when ill are cared for in a building specially set apart for the purpose.

PRECAUTIONS TO PREVENT SPREAD OF CONTAGIOUS DISEASES.

Where a large milk business is conducted and several thousand customers are served daily, there is danger that some contagious disease may be brought to the dairy in some of the bottles. To avoid this, in some instances a wagon makes a special trip to collect bottles from any house where a contagious disease is known to exist. These bottles are thoroughly boiled in a special room before they come to the dairy proper. They are then subjected to the same cleansing process as all the others.

INVESTIGATIONS RELATIVE TO QUALITY OF CERTIFIED MILK.

Milk commissions have sometimes been criticised for not being strict enough with the dairymen in regard to complying with their standards. Reports from the commissions show that in nearly all cases samples are secured from the distributor without warning, which is a very important and commendable practice, for if the milk, when it reaches the consumer, does not comply with the standards which the commission claims to maintain, the product is misrepresented and is a fraud.

In order to determine this point an investigation was made in two of the larger cities where certified milk is sold.

First investigation.—The standard for bacteria of the milk commission in the city where this investigation was made was 10,000 per cubic centimeter. There were four certified dairies supplying milk, and the bacteria count was as follows:

	Bacteria per cubic centimeter.		Bacteria per cubic centimeter.
Dairy No. 1	5,700	Dairy No. 3	5,600
Dairy No. 2	4,200	Dairy No. 4	4,900

It will be seen that the certified milk from all four of the dairies was well within the limits of the standard established by the commission. The analyses were made in the month of November.

Second investigation.—The standard for bacteria established by the commission in this city was 30,000. Nine samples of certified milk were examined with the following results:

	Bacteria per cubic centimeter.		Bacteria per cubic centimeter.
No. 1	9,300	No. 6	11,000
No. 2	2,300	No. 7	6,200
No. 3	21,300	No. 8	5,400
No. 4	13,700	No. 9	2,700
No. 5	12,800		

All of the above samples were well under the standard of 30,000, the highest being 21,300 and the lowest 2,300.

While the bacteria count in these samples is doubtless somewhat lower than would be found under summer conditions, still it is an indication that the commissions are doing careful, honest work.

The reports of commissions indicated that the milk from the various certified dairies follows the standards very closely in composition. Some reported very careful records of examinations for bacteria. As a rule the number of bacteria found was considerably below the number allowed. The Rochester commission reported the average of 100 examinations to be 3,853 per cubic centimeter. The Cleveland commission reported an average of 3,817 for one year, and the Elmira commission 3,500 for the same period. The percentage of fat in the milk reported shows a variation from 3.80 to 5.40 and an average for all certified milk of 4.54 per cent.

SOME GENERAL CONSIDERATIONS.

IS THE DEMAND FOR CERTIFIED MILK INCREASING?

All but one of the commissions reporting stated that the demand for certified milk was increasing. One stated that the demand had doubled in one year and another that it had nearly trebled in two months. New commissions are constantly being organized, and it appears that there is no lack of demand for the product in most instances; but, on the other hand, there is a scarcity of dairymen who are willing to meet the requirements for production imposed by the commissions.

PRICES OF CERTIFIED MILK COMPARED WITH THOSE OF MARKET MILK.

The prices of certified milk to the consumer vary in different cities from 8 cents to 20 cents a quart, the average price for all cities being about 12¼ cents. The price of ordinary market milk varies from 5 cents to 10 cents a quart and averages about 7¼ cents. Certified milk therefore sells for an average of 5 cents more per quart than market milk. As a rule, where the price of market milk is low, the price of

certified milk is also comparatively low, although this does not hold true in all cases. In some cities different prices are charged for certified milk; for example, in New York this product sells at prices varying from 12 cents to 20 cents, while the price of market milk is generally 8 cents per quart.

INFLUENCE OF MILK COMMISSIONS ON THE QUALITY OF THE GENERAL SUPPLY.

Fourteen of the eighteen commissions reporting on this question stated that they believed the commissions had had some influence in improving the general supply; two others stated that they were trying to effect some improvements; one stated that perhaps some influence was exerted, and the remaining one did not venture an opinion. These improvements have been brought about through the influence of the commissions in securing better regulations and higher standards relative to producing and handling milk; in modifying advertisements which misrepresented some of the milk sold in the city; in interesting local papers in clean-milk movements, and in assisting in making prosecutions.

The producers of certified milk also have a good influence upon the general milk supply by setting examples of cleanliness and good management. Milk venders in the city by displaying signs on their wagons showing that their milk has been approved by a commission appointed for this purpose have had a good effect upon the market-milk trade. Market-milk producers are encouraged to make improvements and in time become certified-milk producers, better prices for their product being the principal inducement.

SO-CALLED CERTIFIED MILK NOT CONTROLLED BY MILK COMMISSIONS.

There are a few dairymen who sell their product under the name of certified milk who have no connection with milk commissions. These in some cases certify to their own product, and in others samples are sent to a State experiment station or to some local chemist or bacteriologist for examination. Some dairymen in this class supply a very creditable product. There are others whose milk is of only ordinary quality and who should never be allowed to use the term "certified." Here again the samples for analysis are usually taken by the dairyman himself from milk fresh from the cow and immediately iced and sent to the analyst. The analyst reports his results and the dairyman uses them to advertise his product. This can not be looked upon as anything but a deception, as the consumer is given to understand that this is the analysis of the milk as it is delivered to him daily. It is only when medical milk commissions have been organized and a plan of education has been started to create a demand

for sanitary milk designed for infant feeding that there arises any danger of an impure milk being put on the market under such a label. It is manifestly unfair, therefore, that, after a commission, serving without pay in the interest of the public, has created a feeling that "certified" milk means a safe, clean milk for infant feeding, some unprincipled dairyman should be able to prey on the ignorance of the public and supply an unsafe milk at a high price. Some steps should be taken by the milk commissions or by city or State officers to prevent such practices. Where milk is an article of interstate commerce, however, the national pure-food law covers misrepresentations of this character.

LEGALIZATION OF THE TERM "CERTIFIED MILK."

The State of New York has set a good example in recently passing a law for regulating the sale of certified milk. A portion of the law reads as follows:

> No person shall sell or exchange, or offer or expose for sale or exchange, as and for certified milk any milk which does not conform to the regulations prescribed by, and bear the certification of, a milk commission appointed by a county medical society organized under and chartered by the Medical Society of the State of New York and which has not been pronounced by such authority to be free from antiseptics, added preservatives, and pathogenic bacteria, or bacteria in excessive numbers. All milk sold as certified milk shall be conspicuously marked with the name of the commission certifying it.

Efforts are being made to secure the passage of similar legislation in several other States, and there is every indication that misusers of the term "certified" will be prosecuted in the future.[a]

FINANCIAL SUPPORT OF MILK COMMISSIONS.

Members of milk commissions rarely receive any pay for their work, their services being given gratis for the public good. Small expenses of the commission are usually met by the commission itself. Occasionally philanthropic subscriptions are received. In one city three men contributed $800 after an appeal by the commission. Postage, printing, and salaries of experts are usually paid by the producers. There are several methods used for collecting the money from dairymen to meet these expenses, the most common one being the sale of caps to milk producers at from $4.75 to $5 a thousand. One commission charges a tax of half a cent a quart for certification. Another commission meets its incidental expenses by charging each dairyman $6 a month. The most successful and just method is apparently that of a "per bottle tax."

[a] The Kentucky legislature on February 12, 1908, passed a pure-food law containing provisions regarding certified milk.

THE AMERICAN ASSOCIATION OF MEDICAL MILK COMMISSIONS.[a]

When it is considered how very efficient milk commissions have been in the various communities in which they have been established, it is surprising how few have been formed since the first one was organized in 1893. The spread of this movement was undoubtedly retarded because of the difficulties that presented themselves to those who had such an organization in contemplation. The question was not broadly understood by the medical profession, and even when the organization of a milk commission was determined upon it was difficult to arrive at the most acceptable plan of organization and detail of working methods.

The usual procedure was to get into correspondence with one of the older commissions, which would relate its individual way of handling this problem. If the plan submitted seemed unsatisfactory, other commissions would be written to, and so an endless correspondence resulted, which proved especially burdensome to the Newark, N. J., commission.

The secretary of the Cincinnati commission, Dr. Otto P. Geier, encountered this same difficulty at the period of organization of that commission. It resulted in his sending out a series of 24 questions covering every phase of activity in milk-commission work. These were addressed to every commission then known. This very exhaustive tabulation showed that there existed considerable lack of uniformity as to organization, working methods, supervision of dairies, chemical and bacteriological standards, methods of bottling, capping and sealing, etc.

Out of this mass of correspondence an attempt was made to arrive at the most acceptable standards and working factors, and the conclusion was reached that a conference of the milk commissions would be most valuable to all concerned.

In February, 1907, the Cincinnati commission addressed the various milk commissions suggesting a conference to be held in connection with the meeting of the American Medical Association at Atlantic City. Out of this grew a temporary organization. Dr. Henry L. Coit, Dr. Otto P. Geier, Dr. Samuel McC. Hamill, Dr. Rowland G. Freeman, Dr. William H. Park, and Dr. Thomas W. Harvey, acting as a committee, formulated a program and called the conference for June 3, 1907, at Atlantic City.

This initial conference was remarkable in that delegates were present from 12 different States, representing 21 commissions in as many cities. Over 100 physicians and leading hygienists attended this meeting, and a tremendous amount of work was accomplished.

[a] The writer is indebted to Dr. Otto P. Geier, secretary of the American Association of Medical Milk Commissions, for data regarding the organization of the association.

Reports were read by delegates as to the work of their particular commissions. Papers were presented on the broad topic of a pure-milk supply for cities. A permanent organization was effected, to be known as the American Association of Medical Milk Commissions, and the following officers were elected:

President, Dr. Henry L. Coit.
Secretary, Dr. Otto P. Geier.
Treasurer, Dr. Samuel McC. Hamill.
Council: Dr. Rowland G. Freeman, chairman (5 years), Dr. Henry Enos Tuley (4 years), Dr. C. W. Brown (3 years), Dr. A. W. Myers (2 years), Dr. H. L. K. Shaw (1 year), and the president, secretary, and treasurer of the association.

Committees were appointed upon every phase of activity in milk certification to investigate and report at the next annual meeting.

It can be said that this meeting marks a new era in the pure-milk crusade. It is agreed that this organization is in position to crystallize the best thought that has been given to this subject, and that through such central organization quick dissemination of that knowledge will follow.

A better understanding of this subject will reveal the fact that milk commissions are widening their scope and that through their activity the quality of the general supply of milk in our large cities is being elevated. It will show that it is practical for any medical association to form such a commission, which, once formed, will be most useful in educating the public as well as the profession and in creating a demand for a cleaner milk supply, and will thus further the efforts of boards of health.

The necessity for such an organization is shown by the records of its secretary, who has been in correspondence with 11 commissions organized since June, 1907, indicating an increase of 50 per cent over the number of commissions then known to exist.

The second annual meeting will be held in Chicago June 1, 1908, one day previous to the meeting of the American Medical Association.

II.—THE PRODUCTION OF CERTIFIED MILK.

INFORMATION SECURED FROM PRODUCERS.

In order to secure accurate data relative to the production of certified milk a list of questions was sent to dairymen producing this grade of milk, and the information given is briefly shown in Table 2.

It will be seen from the table that 33 of the 50 dairies producing certified milk in the United States reported in response to queries sent them. Their answers give us sufficient data for a description of the methods commonly practiced in certified-milk production.

Plates I and II show the exterior and interior views of several stables used in the production of certified milk, and Plates III and IV the methods of handling the cows and the milk.

NUMBER AND BREED OF COWS AND QUANTITY AND QUALITY OF MILK.

The number of cows in herds producing certified milk varies from 25 to 500. Practically every breed is represented in some of these herds, and some grade or native stock is found in two-thirds of them. There are several herds of registered animals. The breed is not considered of special importance with most of the commissions, provided the composition of the milk produced is within the limits of the standard prescribed. The health of the animals and cleanliness of the surroundings and product are the most important elements in production. The production of the different herds ranges from 225 to 5,000 quarts daily (though the milk from the largest herd is not all certified). The butterfat in the milk as reported varies from 3.6 to 6.5 per cent and averages about 4.69 per cent. This agrees fairly well with the average percentage of 4.54 reported by the commissions, the difference probably being due to the fact that only 33 dairies are represented in the average for dairies while the average reported by commissions represents practically all the certified-milk producers.

BACTERIA IN THE MILK.

The number of bacteria in the milk, as reported by the dairymen, varies all the way from 200 to 10,000 per cubic centimeter. One (No. 11) has an average of 3,317 for 43 weeks; another (No. 29) reports a count of below 1,000 for one year and an average of 150 for 15 successive weeks from samples taken at random in the city.

METHODS OF CLEANING AND DISINFECTING STABLES.

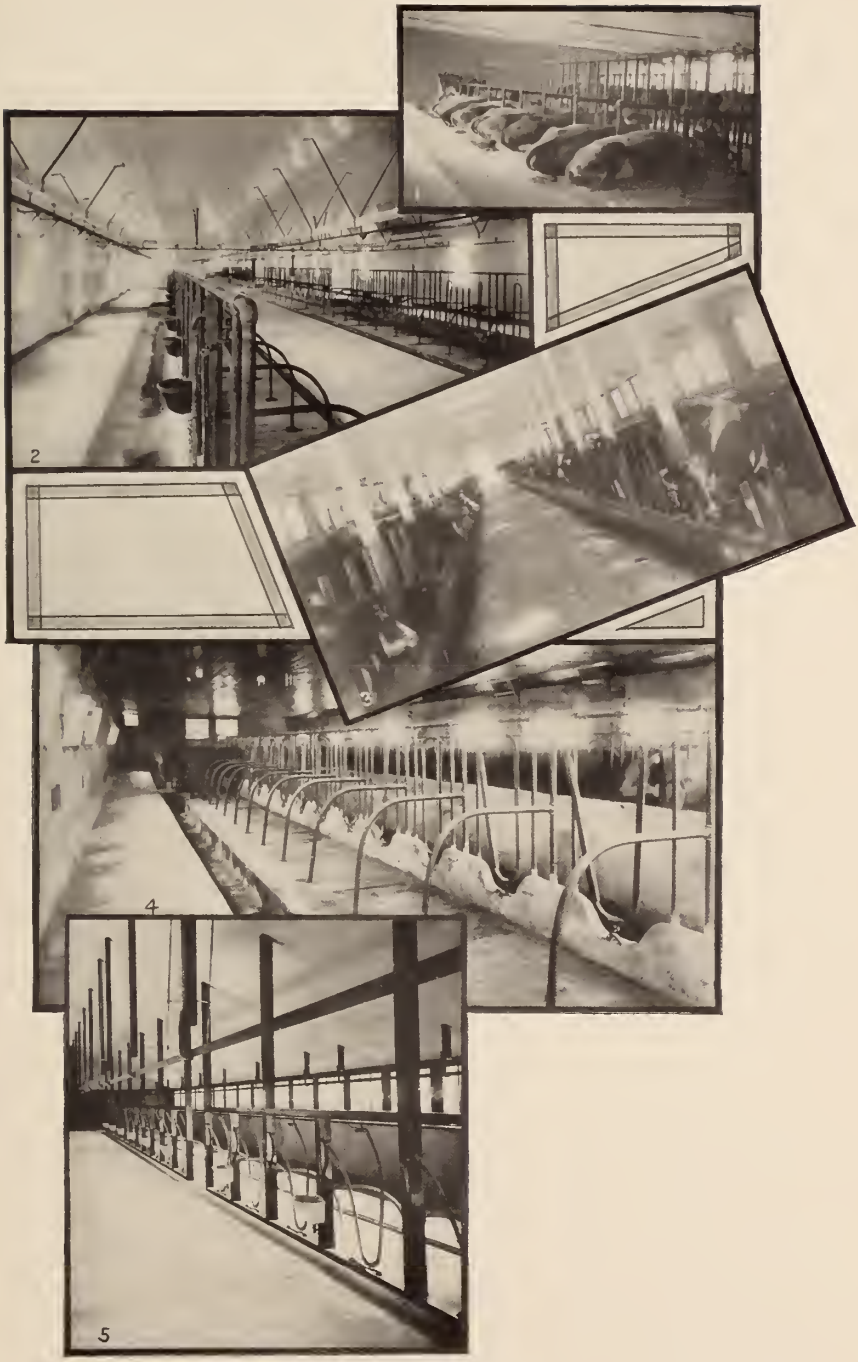
It is the general practice in certified dairies to remove the manure at least twice daily to the field, or to a suitable pit some distance from the stable. In the most carefully managed dairies the whole interior of the stable is washed and scrubbed daily with water con-

TABLE 2.—*Facts relating to production of certified milk in the United States, as reported by dairymen.*

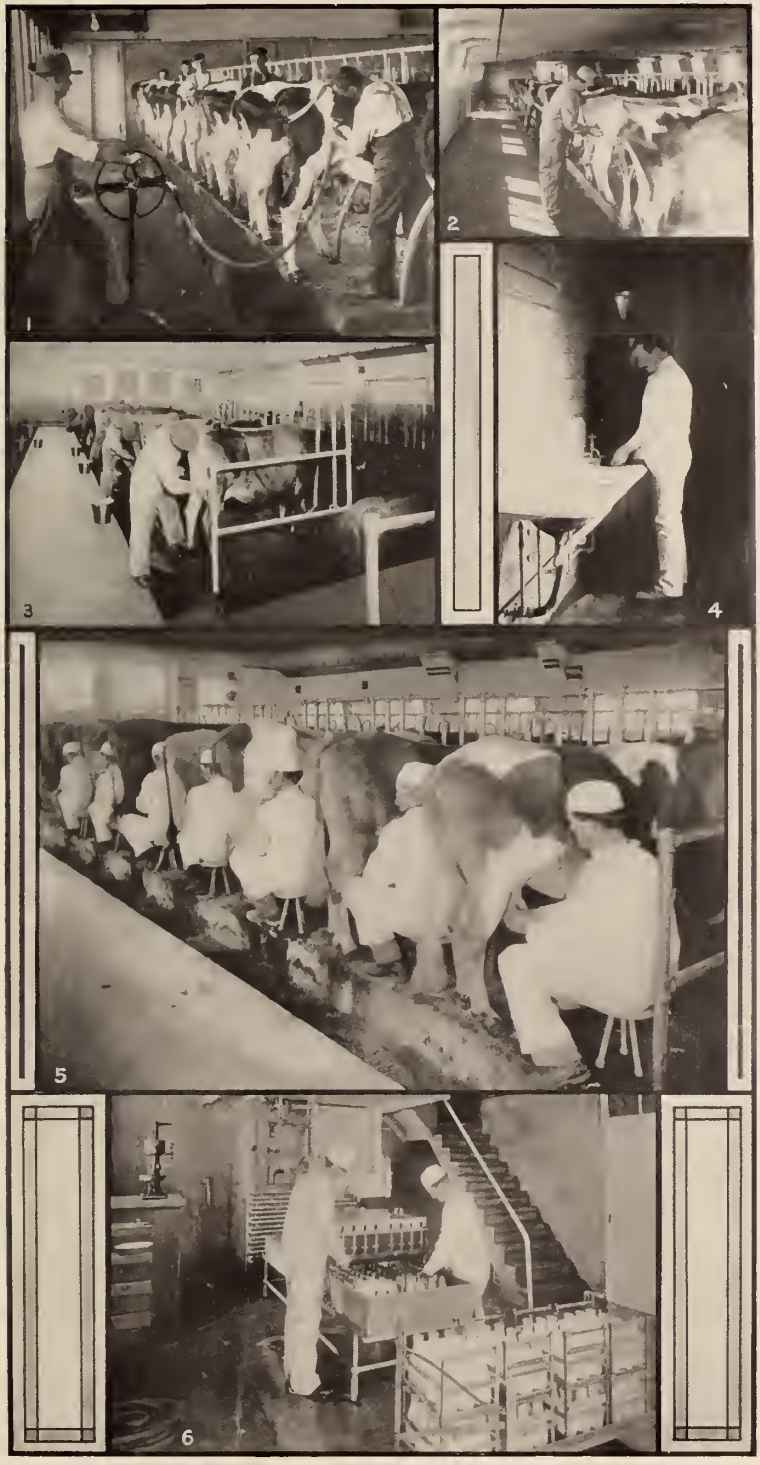
No. of dairy.	Location.	No. of cows in herd.	Milk produced daily.[a]	Breed of cows.	Average quality and condition of milk.		Temperature of milk.		Is production of certified milk profitable?	Price per quart of certified milk.
					Fat in milk.	Bacteria.	Cooled.	Stored.		
			Quarts.		*Per cent.*	*Per c. c.*	° *F.*	° *F.*		*Cents.*
1	East Schodack, N. Y.	25	225	Jerseys, Holsteins, and grades	4.6	3,350	42	42	Fairly so	[b] 5–5½
2	Wawa, Pa	150	1,300	Guernseys, grades, and natives	4.7	2,000–5,000	40	40	Yes	[c] 14–16
3	Barrytown, N. Y	34	200	Jersey and Guernsey grades	5.0	1,500	35	40	Yes	[b] 7
4	Warwick, N. Y	52	540	Mixed breeding	4.0	800–1,000	45–48	50	Yes	
5	Warwick, N. Y	65	650	Durhams	4.0	1,060–2,000	38–40	38–40	Think so	
6	Willow Grove, Pa	40	250	Jerseys (purebred and grades)	4.75	8,000	48	48	Yes	[b] 8½
7	Norwich, N. Y	40	350	Guernseys, Jerseys, and Holsteins	4.5	500–5,000	45–50	45–50	Yes	[b] 6
8	Smithboro, N. Y	60	600	Holsteins and Jerseys	4.3	1,000			Fairly so	[b] 6
9	Malvern, Pa	70	600	Mixed breeds	4.0	4,000	36–40	36–40	No	[b] 7½; [c] 14
10	Oakland, Cal	100	750	Mixed breeds	4.0	500–7,000	50–60	50–60		12
11	Dover Plains, N. Y	56	550	No special breed	4.35	[d] 3,317	40–45	40–45	No	[b] 6
12	Kinderhook, N. Y	50	250	Registered Jerseys	5.9	[e] 9,681	36–40	36–40	Yes	
13	Waltham, Mass	88	900	Mixed breeds	4.1	6,500	50	40	Just begun	10
14	Highland, N. Y	30	150	Jerseys	5.6	100–500	36–40	36–40	No	10
15	Haddonsfield, N. J	75	450	Registered Guernseys	5.0	Under 4,000	40–50	40–50	No	
16	Earlville, N. Y	55	300	Jerseys and natives	4.5	2,800	37	37	No	[b] 6
17	Walden, N. Y	75	500	Jerseys, Guernseys and Natives	4.5	5,000	40–45	40	Yes	12
18	West Vienna, N. Y	103	500	Grade Jerseys, Guernseys, etc	5.0	900	40	40	Just begun	[b] 6–7
19	Greenwood, Mo	65	720	Purebred Holsteins	3.6	8,000	48	48	Yes, at 15 cts	10; [f] 15
20	Selma, Mo	70	560	Jerseys and Holsteins (purebred and grades)	4.7	3,500	45	45	Yes	
21	Tully, N. Y	275	1,900	Jersey, Holstein and Swiss grades	4.5	500–1,000	36–40	36–40	Will be	12
22	White Plains, N. Y	40	360	Jerseys	6.0	600	32–38	32–38	Yes	15
23	Kingsleys, Pa	32	265	Jerseys	5.4	400			No	
24	New Roadhouse, Ill	30	75	Grade Holsteins	4.8	6,000	40–50	40–50		[b] 9
25	Lebanon, Ohio	66	475	Shorthorns and mixed	4.0	2,000	45	45	Yes	14
26	Briarcliff Manor, N.Y.	300	2,853	Jerseys (purebred and grade)	5.65	6,320	38–45	38–45	Yes	[g] 10–20
27	Rochester, N. Y	50	334	Jerseys and mixed blood	4.1	4,000	45–50	45–50		10
28	Pewaukee, Wis	350	2,200	Holstein, Guernsey, and Jersey grades	4.0	2,000	38	50		12
29	Newburgh, N. Y	100	600	Jersey and Guernsey grades	5.0	Under 1,000	40	38		[h] 20
30	Canajoharie, N. Y	40	225	Holsteins and Jerseys	4.0	1,500–5,000	40–50	40–50	Yes	12
31	Anchorage, Ky	21	200	Jerseys	6.5	3,000	45		Yes	[c] 10
32	Fairfield, N. J	517	5,000	Mixed breeding	4.5	Under 10,000	39	40	Yes	[c] 12
33	Cedarhurst, N. Y	52	600	Guernsey grades	5.0	200–3,500	42	42–45	Yes, if large	[i] 10

[a] Approximate.
[b] Wholesale.
[c] Retail.
[d] Average for forty-three weeks.
[e] Average for six months.
[f] For table use, 10 cents; for infant feeding, 15 cents.
[g] In home market, 10 cents; in New York City, 20 cents.
[h] In New York City.
[i] At farm.

Exterior Views of Dairy Stables where Certified Milk is Produced.



Interior Views of Dairy Stables where Certified Milk is Produced.



STEPS IN THE PRODUCTION AND HANDLING OF CERTIFIED MILK.

1. Clipping cows. 2. Cleaning cows. 3. Washing cows preparatory to milking. 4. Milker washing hands. 5. Milking. 6. Cooling and bottling.

STEPS IN THE HANDLING AND DELIVERY OF CERTIFIED MILK.

7. Sealing bottles. 8. Storage. 9. Case of bottles ready for delivery. 10. Delivery wagon. 11. Washing bottles. 12. Sterilizing bottles.

taining a washing compound. Some use a disinfectant in the water once or twice a week, as bichlorid of mercury, carbolic acid, or permanganate of potash. Bichlorid of mercury is probably the most expensive of any of the disinfectants; aside from this fact it is one of the most satisfactory because it gives off no odor. One dairyman uses cresol in water daily. Where the interior of the stable is built of wood, it is whitewashed from two to twelve times annually, or kept well painted. Land plaster is the most common disinfectant for floors and gutters. Slacked lime is also satisfactory for this purpose. Shavings are most in favor for bedding. Some dairymen do not use any bedding, but this system is not recommended.

CLEANING AND TREATMENT OF COWS PREPARATORY TO MILKING.

The cows are cleaned daily with currycomb and brush. (Pl. III, 2.) The udder and parts in proximity to it are either washed and wiped with a clean towel, or are wiped with a damp cloth or sponge. (Pl. III, 3.) In many cases the udder, flanks, etc., are clipped periodically. (Pl. III, 1.) Occasionally a dairyman sprays stables and cows immediately before milking. It is a common practice to fasten up the cows after they have been cleaned, in such a way that they can not lie down till they have been milked.

In a few dairies where extraordinary care is used, the whole body of the cow is groomed an hour or more before each milking, and any soiled parts are scrubbed with a brush and water containing a washing compound; the entire body is bathed from the neck back; the tail is washed; the udder is washed in sterile water from a sterile pail, and dried with a clean towel, a separate one being provided for each cow.

MILKERS AND MILKING.

In a few dairies the milking is not done in the regular stable, the cows being taken to a milking room entirely separated from the rest of the barn. This room is well lighted, and every precaution is taken to make it absolutely sanitary. Other dairymen claim that just as good results can be secured by milking in the regular stable if proper precautions are taken. As some of the lowest bacteria counts on record have been obtained where the latter plan is followed, this fact would seem to substantiate the claim.

The custom is almost universal for the milkers to be clad in freshly laundered suits. Where the most extreme care is taken, the clothing of each milker receives a thorough cleansing with boiling water after every milking, and is then locked in an individual air-tight drying room, where it is sterilized and dried by steam, remaining there until wanted for use. Before putting on their special suits, milkers are required to wash their hands and faces and clean their nails. (Pl. III, 4.) At least one producer requires that before the milker commences his work he shall take a shower bath, provision for which is

made in rooms adjoining the laundry. When ready for milking the milker is supplied with a pail and a stool, both of which have been cleansed and sterilized since last in use. With these extreme precautions, when the milker goes to the milk room, he is as clean in person and equipment as it is possible to make him. (Pl. III, 5.) In milking it is a common practice to discard the foremilk. The milking is done strictly with dry hands, except in a few instances where vaseline is employed (a usage which is reported to be entirely practical). In some dairies milkers are required to wash their hands before milking each cow, but this is not the general practice.

HANDLING THE MILK.

After being drawn the milk is taken immediately to a separate room, where it is strained into a can through a double thickness of cheese cloth (a separate strainer being used for each pail of milk). It is then taken immediately to the bottling room (Pl. III, 6), where usually it is cooled to a temperature as low as 45° to 50° F., and in some cases as low as 35° F. Sometimes it is strained again through absorbent cotton on reaching the cooling room. In a majority of the dairies a cooler of some description is used; in a few, however, the milk is strained into cans standing in ice water. It is then bottled, packed in cases, and covered with crushed ice.

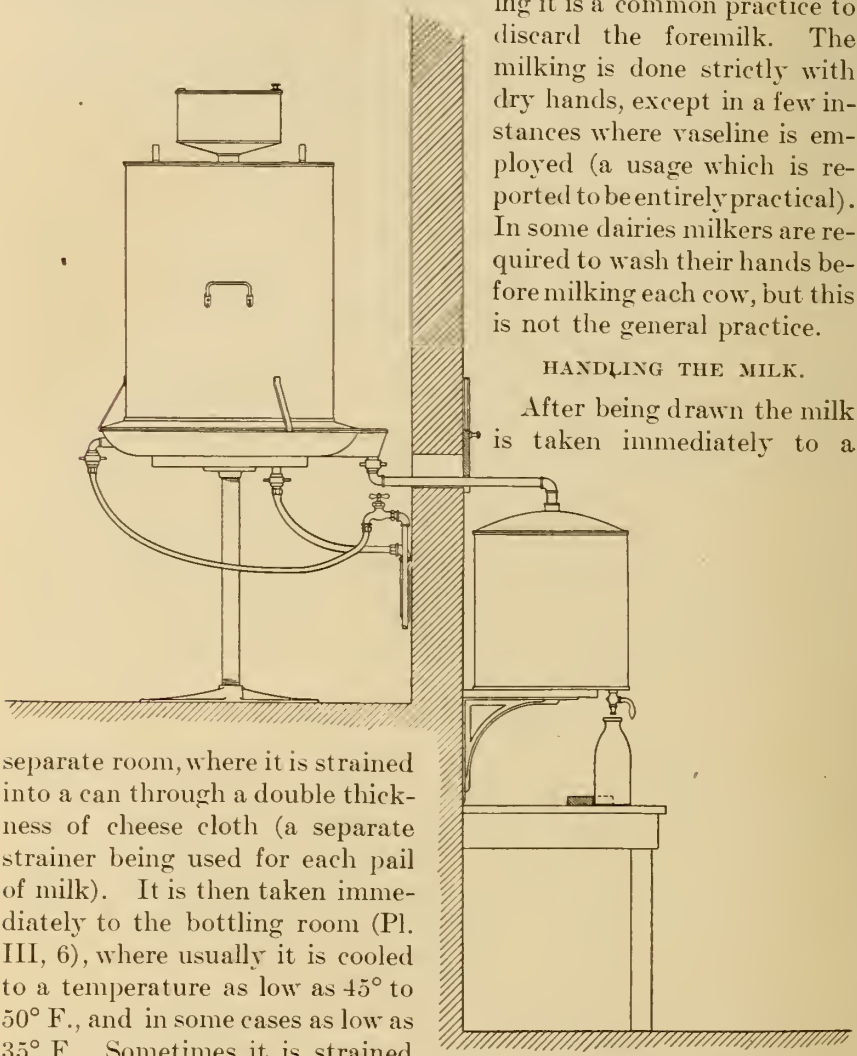


FIG. 1.—An arrangement of cooler and hand bottle filler.

Figure 1 shows an arrangement of cooler and hand bottle filler, and figure 2 is a floor plan for a small dairy house for handling certified milk. If the barn is sanitary the dairy house may be directly attached, the weigh room serving to separate the milk room from the barn. There is probably less danger to the quality of the milk in having the dairy connected with the barn (as shown in fig. 2) than in having these buildings separated by an open space through which the milk is carried after each cow is milked.

The cooler (parts of which are shown in Pl. V) is placed in the receiving room (designated as "weigh room" in fig. 2). After each cow is milked the milk is passed over the cooler and into the hand bottling receptacle in the bottling room. One man bottles the milk without assistance and is able to fill and cap 200 to 300 bottles an hour and place them in the storeroom. It will be seen that this arrangement facilitates prompt cooling and immediate bottling without exposing the milk. The apparatus is very simple, inexpensive (cost not exceeding $150), sanitary, and can be easily and quickly cleaned. It is understood that the apparatus shown in the illustration is designed for the small certified-milk producer with about 50 cows.

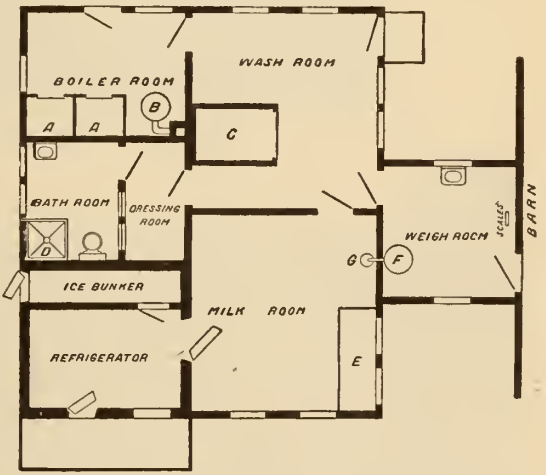


FIG. 2.—Dairy house for certified-milk plant with fifty cows. (*A A*, coal bunkers; *B*, boiler; *C*, sterilizer; *D*, shower bath; *E*, bottling table; *F*, cooler; *G*, receiving can.)

Considering the possibilities of producing certified milk with the inexpensive dairy house (fig. 2) and the apparatus required for cooling and bottling as described and illustrated (see p. 26), the small dairyman should be encouraged to produce certified milk.

The milk coolers in some of the dairies are so constructed that the upper coils of pipe can be filled with hydrant or well water and the lower ones with ice water or brine. The top coils remove much of the animal heat, while the lower ones reduce the milk to a temperature of 35 to 40° F. As the milk is very much exposed in this room, the importance of the air being free from all impurities is apparent. In the best dairies the room is sterilized with steam preparatory to cooling the milk, and in some instances the air entering the room is filtered through absorbent cotton or a spray of water.

The milk from the cooler passes immediately into a tank connected with the bottling machine. Some plants are so arranged that the bottling machine, as well as the bottles, passes through a pressure steam sterilizer before entering the bottling room. Paper caps (made from wood pulp) are universally used on the bottles. The filled bottles are rapidly packed in cases and covered with cracked ice. They are then put in cold storage, or in some cases transported immediately, the ice being renewed as often as necessary in transportation so that a low temperature is maintained until the product reaches the consumer. (See Pl. IV.)

STERILIZING CAPS FOR MILK BOTTLES.

It is important that the milk caps be kept sterile, otherwise the milk is contaminated immediately after being bottled. This is provided for in some instances by the milk commissions, which sterilize the caps and send them to the dairymen in pasteboard boxes, 100 caps in each box. Some dairymen sterilize their own caps by inclosing them in a galvanized iron box or a cloth bag and placing them in the sterilizer. Some use copper tubes for this purpose. (Fig. 3.) These are so constructed that the caps can be removed and placed in the bottles by touching only the edges.

FIG. 3.—Copper case used in sterilizing milk caps.

COVERINGS AND SEALS FOR BOTTLES.

Some producers of certified milk use nothing for sealing the bottles but ordinary pulp caps stamped with the name of the commission and the date. Others use various coverings in addition to the ordinary cap, some of which are shown in Plate VI.

A parchment circle bearing the name of the dairy is frequently placed over the top of the bottle in addition to the pulp cap, and fastened with a rubber band. (Pl. VI, fig. 1, No. 2.) Another style consists of a tinfoil covering on the top of the bottle in addition to the ordinary cap. The covering is sometimes pasted down with a label, making a very neat package, but one too expensive for practical use. (See Pl. VI, fig. 1, No. 4.) The pulp cap sometimes leaks (Pl. VI, fig. 2, No. 4), allowing bacteria to enter.

Sometimes, in addition to the pulp cap, a metal cover is used which fits over the top of the bottle and is fastened with a wire and lead seal. (Pl. VI, fig. 1, No. 1.) While this method affords good protection to the milk, it adds unnecessary expense. However, there is nothing to prevent the pulp cap from leaking and molds from developing. (See Pl. VI, fig. 2, No. 1.)

Fig. 1.—Covered Milk Cooler.

Fig. 2.—Parts of Cooler.

1. Cooler proper. Water passes through interior of coil, and milk over outer surface. 2. Receptacle placed on top of No. 1; has perforations in the bottom near the edge for distributing milk over the cooler. 3. Cover inclosing cooler. 4. Receptacle for receiving the milk and which also contains the strainer. The latter consists of a perforated plate which is put in first; next to this is placed a layer of cheese cloth, then a layer of absorbent cotton followed by another layer of cheese cloth and a perforated plate. 5. A copper ring, filled with lead and heavily tinned, placed on top of parts of strainer to hold them in position.

Fig. 1.—Coverings for Bottles of Certified Milk.

Fig. 2.—Bottles with Outer Coverings Removed.

Still another method is to cover the paper cap with a plug of paraffin on which is placed by means of a rubber stamp the date on which the milk should be used. The whole is then covered with parchment paper fastened with a rubber band. This style is illustrated in Pl. VI (fig. 1, No. 3, and fig. 2, No. 3). The rubber stamp is supplied to each producer by the milk commission and is changed monthly. Every stamp has a secret mark so that all certified milk can be readily identified in the city. The stamp reads "To be sold and used [date]." It is practically impossible to tamper with this seal without the fact being detected. The paraffin has the advantage of sealing the bottle and preventing deception by refilling. It is also cheap, and altogether this makes a most desirable package.

MILK PAILS, STRAINERS, AND STOOLS.

The milk pails used in certified-milk plants present a great variety of styles. Generally speaking, they have a small opening (5 to 8 inches.) Some are provided with a strainer through which the milk passes in entering the pail. This consists, in some instances, of several thicknesses of cheese cloth, in others of both cheese cloth and absorbent cotton, and in still others of metal wire. One form of pail also serves the purpose of a stool. (Fig. 9.)

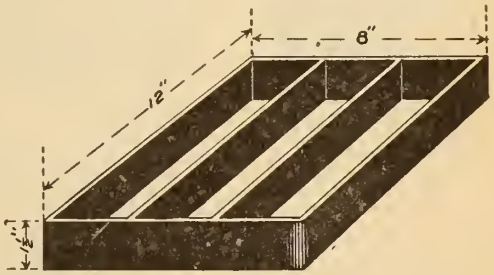


FIG. 4.—Metal frame on which milk pails are set in stable to keep them out of the dirt.

The styles of milk pails shown in figure 5 were reported as actually in use at certified-milk plants. No attempt has been made to illustrate all the kinds of pails in the trade. The cuts, however, give a good general idea of the forms commonly found on certified dairy farms. (Figs. 5, 6, and 7.)

No. 1 has the advantage of being stamped from one piece of tin. The strainer, however, is poorly constructed, having a metal sieve permanently soldered in the bottom, and the top rolled over, making it difficult to keep clean. This pail would doubtless give better results in fairly clean dairies if the strainer were discarded altogether.

No. 2 has a removable cover, cheese cloth being spread over top of pail before cover is put on. It is a fairly good pail, but the removable cover has no special advantage over the one-piece pail and it makes one more part to keep clean. The cover must be removed after each milking, thus adding to the danger of contamination.

No. 3 is similar to No. 1, except that it has a strainer simpler in construction and hence more readily cleaned.

No. 4 is a substantial small-top pail. It would be improved by a hood similar to that of No. 5. It is difficult for the milker to hold, on account of being smaller at the top than at the bottom.

No. 5 exhibits the best principles. There is no strainer attached, and the hood prevents dust and dirt from dropping into the milk when the pail is tipped in the position used in milking. It should be made of one piece of tin. It is, however, not as easy for the milker to hold as styles 1, 2, and 3.

No. 6 is a very popular pail with certified-milk producers. Absorbent cotton is placed in the top between two layers of cheese cloth, and this serves as a strainer during milking. The cap is removed from the opening at the right to pour out the milk. This pail altogether is a little complex and requires careful cleaning to keep it in good condition. The absorbent cotton also adds some expense. Clean dairies do not require a pail with a strainer, and if no strainer is used the extra spout is of no value.

FIG. 5.—Some forms of milk pails used in certified dairies.

No. 7 is a porcelain pail with adjustable tin cover similar to No. 2. Cheese cloth is placed over the top of the pail before the cover is put on, and serves as a strainer.

No. 8 is an ordinary open pail with no provision for keeping out dirt. It should not be used in any dairy.

No. 9 is a good sanitary pail. It has a small top provided with a metal strainer. In certified dairies probably better results would be secured by leaving out the strainer. The pail would be improved if stamped from one piece of tin.

Nos. 10 and 11 illustrate the same pail, No. 11 showing a section of the interior. This pail is objectionable for the reason that the cover is carelessly soldered in, leaving an open seam (*a*) which collects dirt and is impossible to keep clean.

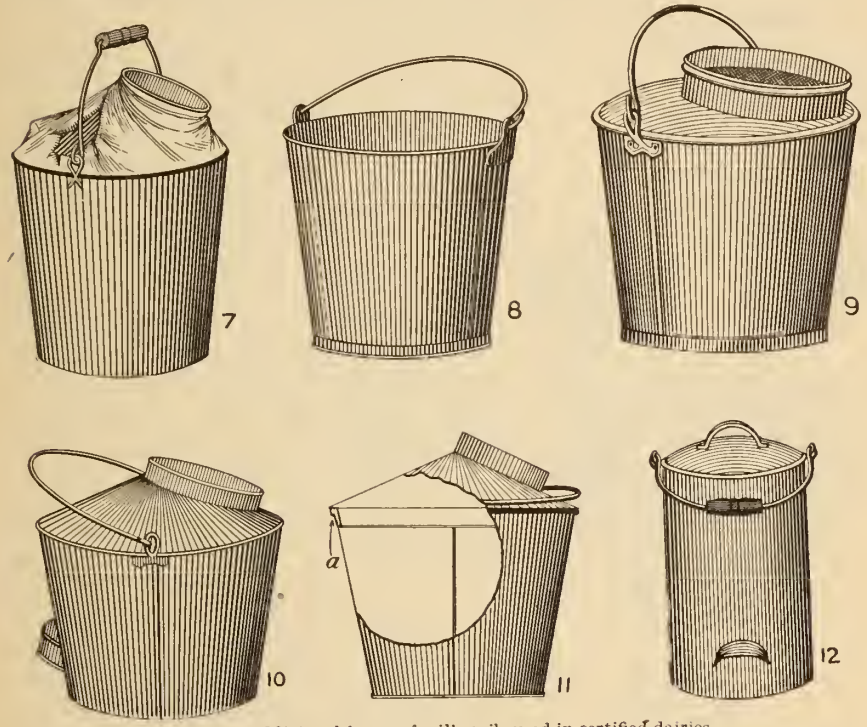


FIG. 6.—Additional forms of milk pails used in certified dairies.

No. 12 shows the shape of an ordinary cream can. The opening is too large and the can is not provided with a hood. The can has too many seams, and it is not ordinarily built strong enough for milking.

No. 13 is a good, sanitary milk pail. The height is convenient, and as the opening is on the side there is but little chance for dirt to fall in. The seams are well flushed with solder. The objection to this pail, if any, is the difficulty of seeing that all parts are clean.

No. 14 is a sanitary milk pail showing cup attached for holding the foremilk. The most objectionable feature of the pail is the difficulty of seeing whether all parts of the interior are clean.

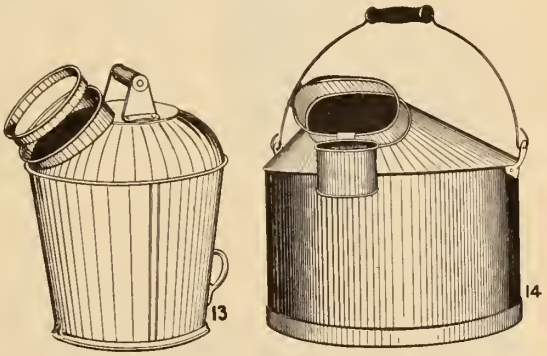


FIG. 7.—Two more forms of milk pails used in certified plants.

As already stated, there are other sanitary milk pails on the market which are not presented here simply because their use has not been reported in this investigation.

Aside from the strainers used in the pails, absorbent cotton is generally preferred. This is usually inclosed between two thicknesses of cheese cloth, a method which is found to be very practical.

The only object in having a strainer in a certified dairy is for safety. There should be no visible dirt or dust on the strainer, but in case a hair or any particles of dirt should accidentally fall into the milk the strainer prevents it from passing into the can and finally into the bottle. The strainer also acts as an indicator and shows whether or not the milking has been done in a cleanly manner. It is believed to be best not to have a strainer of any kind in the milk pail, as its absence has a tendency to make the milker use the utmost care in his work, because he knows that if any particles of dirt fall they will go directly into the milk. After milking each cow the milk should be strained through two or more thicknesses of cheese cloth or through sterilized cotton. Either one of these can be thrown away after use and there are no strainers to wash. Metal strainers are not necessary or desirable in a certified-milk plant. When they are used they should be so constructed that they can be taken apart for thorough cleaning.

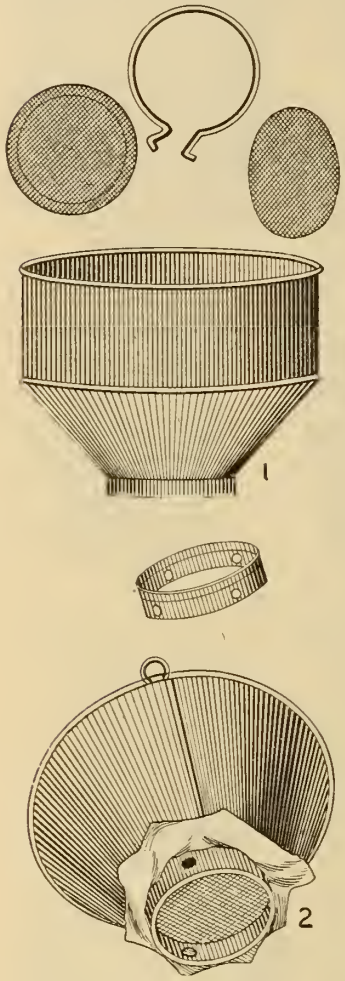


FIG. 8.—Form of strainer used in a few certified plants.

Figure 8 shows a form of strainer used in a few certified dairies. It has adjustable sieves which facilitate cleaning. While this style is commonly used where milk is more or less dirty, some simple form such as two or three thicknesses of cheese cloth which can be thrown away after straining each cow's milk is better. Metal parts are difficult to keep sterile and may add more bacteria than they remove.

The milk stools used in certified plants vary greatly in construction, style, and material. Some are constructed wholly of wood and some have metal legs and wooden seat; those in most common use are

made of heavy galvanized iron; these will stand constant sterilizing and never wear out.

Figure 9 shows a number of forms of stools that have been reported in use at certified dairies.

No. 1 is a good type of sanitary stool made of metal. The ends of the pipes used for the legs are filled with lead, and there are no corners to collect dirt.

Nos. 2 and 4 are similar to No. 1, except that caps are screwed on the ends of the legs, making them slightly more difficult to keep clean.

No. 3 serves for both pail and milk stool. The cover, hoops, bail, etc., make it more difficult to keep clean than the simpler styles.

No. 5 is devised so that one end serves as a receptacle to hold the pail while the milker sits on the other end. As in the case of No. 3, this style is more difficult to keep in a sanitary condition than the simpler forms.

No. 6 is constructed entirely of iron, galvanized after being put together. It is simply constructed, having only a single leg. The base, however, furnishes a larger surface to keep clean.

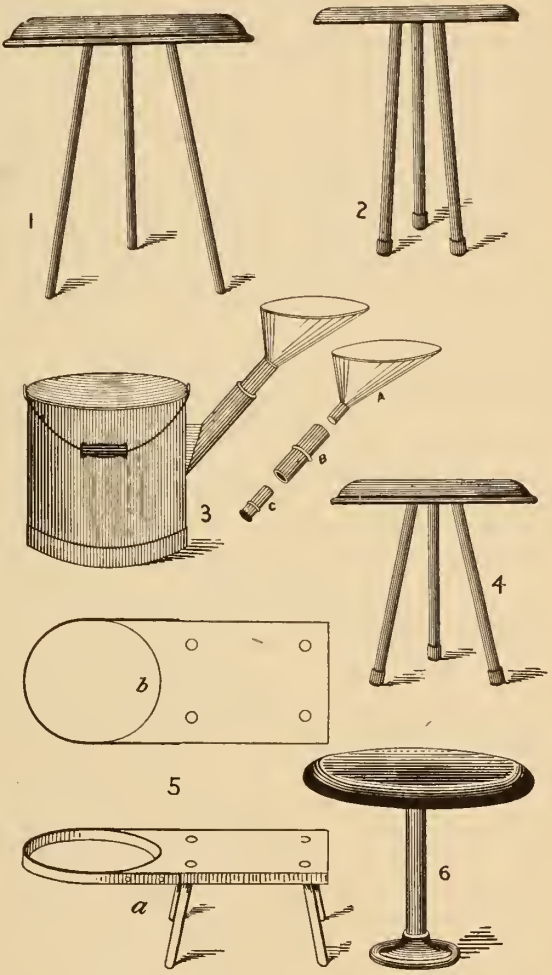


FIG. 9.—Milking stools used in certified dairies.

PRICES RECEIVED FOR CERTIFIED MILK.

The lowest price reported for certified milk delivered at the local railroad station was 5 to 5½ cents a quart in cans, the dealer paying the transportation charges. One producer bottles his milk and sells it for 6 cents a quart wholesale. The dealer furnishes the bottles and cases and pays the freight. The highest price received for certified milk bottled at the farm and delivered to the local station was 10 cents a quart. The retail price for certified milk ranges from 10 to 30 cents a quart, and the retail price of cream varies from 30 to 50 cents a quart. The reports received from the milk

commissions show that prices received for certified milk average about 5 cents a quart higher than prices for ordinary market milk. It should be noted that the prices given here are largely wholesale or prices received by the dairymen, while those reported by the Commissions in another part of this bulletin are largely retail or prices paid by the consumer.

IS THE PRODUCTION OF CERTIFIED MILK PROFITABLE?

Eighteen certified milk producers reported the business profitable or fairly so. (See Table 2.) One stated that it was not profitable at less than 15 cents a quart. Several stated that it was profitable if conducted on a large scale. Nearness to market and facilities for transportation also affect the profit. Difficulty in securing competent help and lack of appreciation on the part of the public were reported by some to be drawbacks to their business. In many instances the business has not paid owing to the great expense for buildings and equipment, but much of this expense was entirely unnecessary. Sanitary conditions and extreme care are far more important requisites in the production of certified milk than fine architecture and expensive and superfluous apparatus.

SANITARY CONDITIONS OF CERTIFIED MILK DAIRIES.

In order to determine the sanitary conditions existing in certified milk dairies, sixteen were visited by a representative of the Dairy Division and scored on the basis of the official score card prepared and used by the Dairy Division. The result of the scoring is shown in Table 3.

TABLE 3.—*Detailed scores of sixteen certified dairy farms.*[a]

No. of dairy.	Cows (perfect score, 20).	Stables (perfect score, 25).	Milk house (perfect score, 20).	Milking (perfect score, 15).	Handling of milk (perfect score, 20).	Total score (perfect, 100).
1	20.00	13.00	19.00	12.00	15.00	79.00
2	20.00	17.00	15.00	13.00	16.00	81.00
3	19.50	20.50	16.00	12.00	15.00	83.00
4	20.00	22.50	17.00	12.00	15.00	86.50
5	20.00	23.00	17.00	13.00	19.00	92.00
6	20.00	19.00	20.00	15.00	20.00	94.00
7	19.75	23.50	20.00	14.00	18.00	95.25
8	20.00	22.00	20.00	15.00	20.00	97.00
9	20.00	21.90	19.60	15.00	20.00	96.50
10	20.00	22.30	20.00	15.00	20.00	97.30
11	19.25	23.50	20.00	15.00	20.00	97.75
12	20.00	24.00	19.50	15.00	20.00	98.50
13	20.00	24.00	20.00	15.00	20.00	99.00
14	20.00	24.50	19.50	15.00	20.00	99.00
15	20.00	24.50	20.00	15.00	20.00	99.50
16	20.00	24.50	20.00	15.00	20.00	99.50
Average	19.90	21.80	18.90	14.10	18.60	93.40
Per cent of perfect score	99.5	87.2	94.5	94	93	93.40

[a] The farms were scored in most instances by Dr. E. M. Santee, assistant dairyman.

A study of the scores shows the cows to be in almost perfect condition, the average score being 19.9 points out of a possible 20. All the animals had been tested with tuberculin.

The greatest defects were found in the stables, some showing poor construction, while others were scored off a point or two for lack of cleanliness. Occasionally the light and the ventilation were poor. The average score for the stables was 21.8, perfect being 25.

The condition of the milk houses was generally good. Seven had slight deficiencies in construction and 5 were scored off a point or two on equipment. Fourteen of the 16 were given a perfect score for cleanliness, 14 were perfect on utensils, and 15 had good water supply.

The methods of milking were good. Clean, white suits were worn by the milkers in nearly all cases, and proper attention was given to the udders and flanks of the cows before milking. The average score for milking was 14.1 points out of a possible 15. Ten dairies received a perfect score.

The milk was handled by the most approved methods in most instances, and promptly cooled to a temperature low enough to keep the bacteria in check. The average score for handling the milk was 18.6 out of a possible 20. Ten dairies received a perfect score.

Averaging the scores for all the conditions, we find 1 dairy below 80, 3 over 80 and less than 90, and 12 over 90; 2 scored 99, and 2, 99.5. The average score for all dairies was 93.4. Comparing these conditions with the average of some 2,000 dairies producing ordinary market milk for city consumption, we find a striking contrast, the average score for the latter being about 50.

THE QUALITY OF CERTIFIED MILK.

It was arranged to have 12 samples of certified milk sent to Washington from various points for analysis. These were tested for solids, fat, bacteria, acidity, and flavor; and were scored on the basis of a score card prepared for this purpose. Table 4 shows the results of the scoring.

TABLE 4.—*Analyses of samples of certified milk (four days old) shipped to Washington from points in New York, New Jersey, Pennsylvania, Ohio, and Kentucky.*[a]

Sample No.	Flavor.	Fat.	Solids not fat.	Total solids.	Acidity.	Total bacteria per c. c.	Condition of package and contents.
	DESCRIPTIVE SCORE.						
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*		
1	Good	6.50	9.80	16.30	.198	3,800	Trace of foreign matter.
2	Good	3.75	9.75	13.50	.216	1,000	Do.
3	Good	6.30	9.76	16.06	.199	4,800	Do.
4	Slight silage taint.	5.05	8.88	13.93	.180	3,500	Good.
5	Silage and salty	[b] 5.60	9.99	15.59	.201	1,820	Trace of foreign matter.
6	Fair	5.20	8.79	13.99	.198	3,050	Do.
7	Slightly bitter	4.50	9.40	13.90	.189	10,900	Good.
8	Slight silage flavor	5.00	9.00	14.00	.203	7,700	Trace of foreign matter.
9	Good	4.60	9.17	13.77	.187	3,600	Good.
10	Good	4.50	9.02	13.52	.198	280	Do.
11	Slight silage flavor	4.70	9.40	14.10	.197	[c] 19,000	Do.
12	.....do	4.70	8.94	13.64	.201	2,750	Do.
	Average	5.03	9.33	14.36	.197	5,183	

[a] The samples were analyzed by Ivan C. Weld, assistant dairyman in the Dairy Division, who also assisted in the scoring.

[b] Sold for 5 per cent milk.

[c] Analyzed and scored when five days old, owing to delay in transportation.

TABLE 4.—*Analyses of samples of certified milk (four days old) shipped to Washington from points in New York, New Jersey, Pennsylvania, Ohio, and Kentucky*—Con.

NUMERICAL SCORE.

Sample No.	Flavor (perfect score, 40).	Composition (perfect score, 25).	Bacteria (perfect score, 20).	Acidity (perfect score, 5).	Appearance of package and contents (perfect score, 10).	Total score (perfect, 100).
1	36.50	17.00	16.00	3.50	9.00	82.00
2	37.50	25.00	20.00	1.50	9.00	93.00
3	36.00	17.00	15.00	3.50	9.50	81.00
4	31.50	22.00	16.00	5.00	10.00	84.50
5	32.00	25.00	18.00	3.00	9.50	87.50
6	33.00	22.00	16.00	3.50	9.50	84.00
7	35.00	25.00	9.00	4.50	10.00	83.50
8	35.25	23.00	12.00	2.50	9.50	82.25
9	36.50	24.00	16.00	4.50	10.00	91.00
10	36.25	25.00	20.00	3.50	10.00	94.75
11	35.00	24.00	5.00	3.50	10.00	77.25
12	36.00	24.00	17.00	3.00	10.00	90.00
Average	35.00	22.75	15.00	3.46	9.70	86.00

The scores show that the milk was generally of good quality. Five samples showed a slight silage taint, which reduced the score somewhat on this point. From observations made by the writer it is believed this flavor was transmitted to the milk more frequently from silage odors in the barn during milking than from feeding silage. One sample was slightly salty and another slightly bitter. The average score for flavor was 35 points out of a possible 40.

The fat in the milk with one exception reached 4 per cent or higher. Four samples were above 5 per cent, two of these being above 6. These considerably exceeded the limit specified by the commissions. While the customer receiving this high quality of milk would have the advantage in quality, it is believed that the fat in certified milk should be kept within the limits specified by the commissions. As stated on the score card, 1 point is deducted for every one-fourth per cent variation from the limits of 3.5 and 4.5 per cent, hence some scores were reduced quite materially for this reason. The average for all the samples was 5.03 per cent, solids not fat 9.33, and total solids 14.36. The average score for composition was 22.75 points out of a possible 25.

All of the samples were cut a little for excessive acidity, but it should be stated that the milk was four days old when scored, and in some cases it had been shipped without ice. The average acidity was 0.197 per cent, and the average score for acidity was 3.46 points out of a possible 5.

The bacteria in the milk showed a great variation in numbers, the highest number being 19,000 per cubic centimeter and the lowest 280. Deductions were made for counts exceeding 1,000 per cubic centimeter on the basis of the score card. The average count was 5,183 and the average score for bacteria was 15 points out of a possible 20.

The style of the packages and the appearance of the contents so far as foreign matter was concerned were generally good. Six of the samples had a slight trace of sediment. The average score was 9.7 points out of a possible 10.

The total score for all samples was 86 on the basis of 100 for perfect. One hundred and forty-four samples of market milk recently scored by the Dairy Division averaged 81.4, indicating that the quality of milk sold as certified was quite superior to the ordinary product in spite of the fact that it was from three to four days old when scored, while the market milk was scored the same day it was produced.

CERTIFIED MILK AND MARKET MILK COMPARED.

As far as the chemical composition is concerned, certified milk does not differ materially from ordinary market milk. The milk commissions require that the fat and total solids shall come within certain limits, and for this reason there is but little variation in the chemical composition of certified milk. The standards are not high for the reason that milk containing about 4 per cent of fat is considered to be the best for immediate consumption. As stated elsewhere, many of the herds in certified-milk dairies are composed of grade cows and do not produce milk of more than the average richness.

When we compare the bacterial content of certified and market milk we find a very striking difference. The bacteria in the average milk supply of our large cities exceed 500,000 to the cubic centimeter, while the bacteria in certified milk seldom exceed 30,000 to the cubic centimeter and in most instances average less than 10,000. There have been some cases where commissions have reported that no bacteria were shown to be present by the ordinary methods used for their detection. Liquefying, putrefactive, and pus-forming bacteria are seldom present in large numbers; in fact the contracts of some commissions with the producers specify that the milk shall not contain pathogenic bacteria or more than a limited number of pus cells to the cubic centimeter.

KEEPING QUALITIES OF CERTIFIED MILK.

As would naturally be expected, certified milk with its small number of bacteria will keep sweet for a long time. The theory that clean milk should have a long keeping quality works out in practice. Instances are on record where certified milk has been taken on an ocean voyage and not only brought back in good condition but kept sweet until thirty days old. In fact it is now a common practice for people when crossing the water or taking a long land journey with infants to take several cases of certified milk with them. They are then reasonably sure of having a constant supply of sweet milk for several days. Some producers who guarantee their milk have offices in London as well as

in this country so that a supply of fresh milk can be secured by voyagers going in either direction. This has been a great convenience and has given comfort to many people. Again, a number of certified-milk dairies in the United States sent exhibits of milk to the Paris Exposition in 1900. The milk kept perfectly sweet for two weeks and in some instances 18 days after being bottled and after a summer journey of 3,000 to 4,000 miles. Regular delivery bottles were used, the only extra precaution being to use two paper caps instead of one, and to cover the caps with paraffin so as to exclude the air. Of course the milk was carefully packed in ice for shipment, but this was the only means used for preservation.

The results of the milk and cream contest at the National Dairy Show held in Chicago in February, 1906,[a] were of interest in showing the keeping quality of certified milk and cream. Some of the milk exhibited was shipped over 1,000 miles and was still sweet after five weeks, and in one instance seven weeks, from the time it was shipped. These results tend to show that what is needed more than anything else, in order to improve the milk supply, is cleaner milk.

IS CERTIFIED MILK WORTH THE EXTRA COST?

In view of the extreme care and greater expense required in the production of certified milk, the question is sometimes raised as to whether it is worth the labor and pains necessary to produce it. It must be conceded that pure milk is of vital importance in the feeding of infants. The best way to produce it is by the methods commonly practiced in certified-milk plants as already outlined in this bulletin. The result of feeding such milk to infants and children in our cities, as shown in the decrease in the death rate, is a matter of common knowledge. Further, with more refined ideas of living, there is a growing demand for milk of the highest quality that can be produced. Naturally, with the careful methods used in its production, certified milk costs more than ordinary market milk, and the price charged for it is correspondingly higher. In spite of this advanced price, however, a number of certified dairies have failed to make a profit.

Certified milk, produced under the direction of a reliable milk commission, is worth more than ordinary market milk for several reasons: (1) It is free from disease-producing bacteria, and all other germs are reduced to a minimum. (2) It is free from high acidity and pathogenic germs which lead to stomach derangements and kindred troubles. (3) The customer can always depend upon his milk coming from the same farm, the same herd of cows, subjected to the same treatment, and having the same quality. The fat content is guaranteed not to vary outside of narrow limits; hence the milk is always

[a] Bureau of Animal Industry Bulletin 87.

of good quality. (4) Cleanliness and cold are the only preservatives used. (5) It is a safe food for infants and people with delicate digestion. (6) It is the natural product of the cow, and has not been subjected to any treatment which affects its digestibility or changes its character. (7) It is reasonably free from foreign odors and objectionable flavors.

THE FUTURE OF THE CERTIFIED-MILK INDUSTRY.

The production and sale of certified milk will probably never amount to more than a small fraction of the total milk consumed. It is believed, however, that the demand for this class of milk will increase, not only for infants and persons of delicate health, but for people who appreciate a good product and want the best. There is over a score of cities at the present time each of which is supplied with certified milk from one or more dairies, and it is believed that most cities of a population of 25,000 to 50,000 or more would support a certified-milk dairy if the product were properly advertised and its merits generally known to the public. Physicians assist greatly in the sale of certified milk, and, as a number of them are usually members of the milk commissions in the various cities, they are thoroughly acquainted with the conditions under which the milk is produced and freely recommend its use.

AN ECONOMICAL METHOD OF PRODUCING CERTIFIED MILK.[a]

This description is not intended to interest those who are desirous of building show plants, but only those who want to produce certified milk of superior quality at the minimum cost for buildings, equipment, and operation. There are a few essential points in the production and handling of certified milk which must be observed. If these details are strictly adhered to, the quality of the milk, so far as the bacterial content is concerned, is assured.

The following are the points to be regarded as the most important:

1. The health of the cows.
2. The sanitary construction of the barn.
3. The sanitary condition of the barn.
4. The sanitary condition of the cows.
5. The sanitary condition of utensils.
6. The sanitary condition of clothing.
7. Sanitary methods of milking.
8. Few utensils, simple in construction.
9. Rapidity of cooling.
10. Sanitary bottling room.

[a] This article was prepared by B. D. White, assistant dairyman in the Dairy Division, at the author's request, and shows an economical method for the production of certified milk as practiced several years by Mr. White when superintendent of a certified dairy in Minnesota.

11. Rapid bottling into sterilized bottles.

12. Keeping filled bottles covered with chopped ice from time of filling to time of delivery to consumers.

No attempt will be made to theorize, but the writer will simply state his practical experience and the results obtained under such conditions.

Health of the cows.—Every cow was tested at least once each year for tuberculosis by a competent veterinarian, and new animals to be placed in the herd were tested, then isolated for three months and tested again. Herds have been contaminated by purchased animals which did not react when purchased, but showed a decided reaction

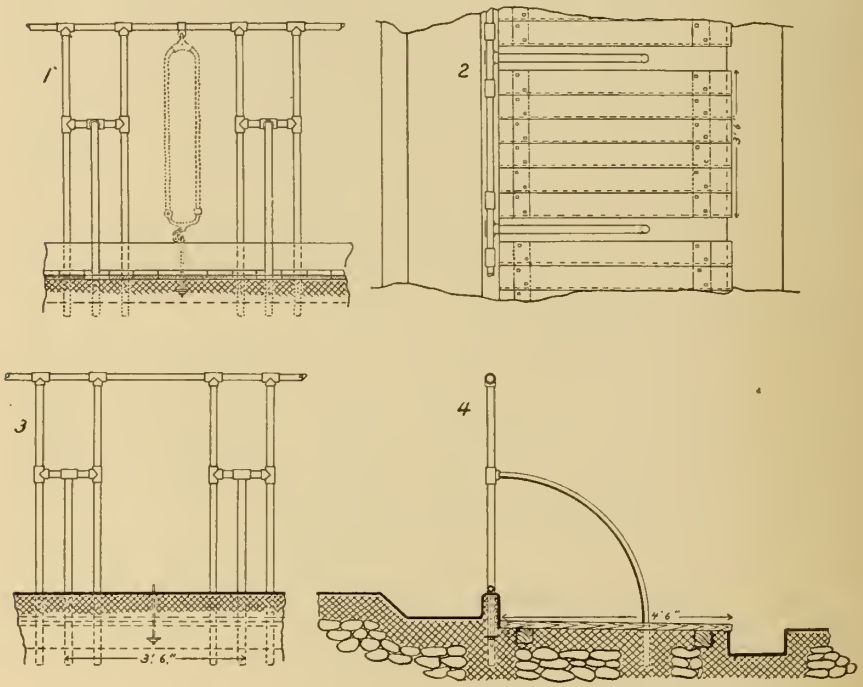


FIG. 10.—Stall with panel wooden floor.

a few months thereafter, thus showing the necessity for this practice. The cows were watched for other diseases and ailments, and when one showed symptoms of any trouble she was immediately removed from the herd and her milk was rejected.

Sanitary construction of barn.—The barn was a one-story structure of wood with plenty of light and provided with the King system of ventilation. The floor, wall, and manger were of cement; the ceiling was lath and plaster; swing stanchions were used for ties. It was found that the cement floor was too hard for the cows to stand on and was the cause of various troubles, such as garget, etc.; consequently it was later covered with 2-inch matched pine flooring, which gave better results.

In building again we would substitute panel floors for stalls, as illustrated in figure 10. Two pieces 4 by 4 inches by 3 feet are laid in the concrete, and a panel 3 feet wide made of 2 by 6-inch matched plank nailed to them. The panel projects over the gutter about 1 inch. A space of 6 inches is left between panels which is cemented level with the top of the plank. This admits of taking up a panel and putting in a new one without disturbing the rest of the floor. In putting down a floor in a new barn, or in replacing an old floor, it is recommended that tar be used in the joints and on the lower surface of the floor.

In the construction of a barn intended for the production of certified milk care should be taken to have as few posts as possible, and preferably no cross beams or braces should be exposed. The interior should be smooth with no place for the lodgment of dust.

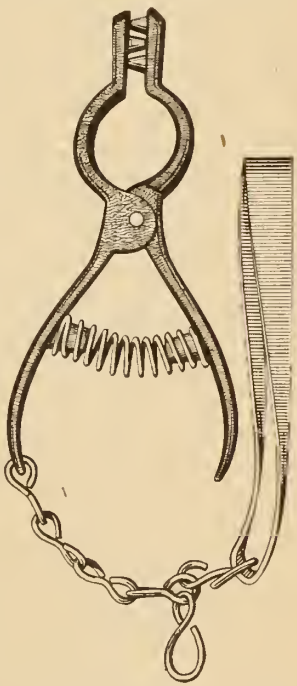


FIG. 11.—Cow-tail holder. The pincers snap around the cow's tail and the rubber band is passed around the leg and hooked into the open link on the chain.

Sanitary condition of the barn.—With the construction of such character that a barn may be kept clean, it only remains to use energy, water, and washing powder.

Sanitary condition of cows.—The cows as well as the barn must be kept clean. Experience has shown that the sanitary condition of the cows has as much to do with the bacterial content of the milk as any other factor. The method used was first to place the cows in a stall according to their size, to have sufficient bedding to keep them clean and comfortable, to keep the hair short in the region of the udder, to groom the cows every day, to wash them before every milking with clean, warm water and a brush, and just before milking each cow to clean the udder again with a clean wet towel. During fly time the tails of three cows (the one to be milked and the one on either side) were fastened with cow-tail holders. (See fig. 11.) After the cows were washed a small chain was fastened across the stanchions under the cows' necks to prevent them from lying down; after they were milked the chains were unfastened and the cows were allowed to lie down.

The manure was not removed immediately before milking, and nothing was done which would raise a dust, as dust is one of the most prolific sources of milk contamination.

Sanitary condition of utensils.—All utensils with which the milk came in contact were washed, rinsed, and steamed, or sterilized in a pressure sterilizer.

Sanitary condition of clothing.—Milking suits were provided which consisted of white duck trousers, a black belt, and a khaki shirt, these making a neat and sanitary uniform. During the summer months the sleeves of the shirts were rolled up to or above the elbows. These suits were washed twice a week. With tight-fitting clothes there is less danger of contamination than with loose coats.

Sanitary method of milking.—With a clean barn, clean and healthy cows, clean utensils, and milkers wearing clean clothes, all that remains is care. However, it may be mentioned that it was the practice to wash the hands thoroughly before milking, and each milker was provided with an individual towel which was used only once. After the hands were washed and dried and a small amount of vaseline was rubbed on the palms, each milker took a pail, which had been previously sterilized by steam, and a clean metal milking stool, and proceeded to the stable with stool in one hand and pail in the other. The milkers did not touch the cows with their hands, except the teats. Care was taken in holding the pail (which was of the style shown in fig. 6, No. 9, except that the strainer was discarded) at an angle, so that there was but little if any chance for dirt to drop into the pail. After milking each cow the milker immediately proceeded to the milk room, carrying the pail with its opening away from him. The top of the pail was brushed with a clean damp cloth, and then the milk was poured into the covered receptacle, from which it flowed over the cooler, which was in the milk room attached to the barn. The milker then washed his hands in clean water and dried them with a clean towel and returned to milk another cow. The foremilk from each cow was caught in a separate receptacle and discarded.

Utensils and equipment.—The plant was originally equipped with the most elaborate apparatus money could buy, but after a thorough trial with poor results it was practically all discarded, including sterilizer for milking suits, large open cooler with many receptacles, conductors, etc., and elaborate anterooms connected with washrooms and baths. Theoretically and for show purposes this appeared all right, but it had no place in practice. When simpler apparatus was installed and simpler methods were practiced no difficulty was experienced in keeping the bacterial content down to an average of 2,000 per cubic centimeter.

Cooling.—Experience leads us to believe that the rapidity with which milk is cooled has a wonderful influence in keeping down the bacteria. Instead of drawing the milk and placing it in a can and when the can is full sending it to the dairy house to be passed through and over the surface of several different contrivances to be strained, cooled, and conducted to the bottling machine, the cooling was effected within 60 seconds from the time the milk was drawn from the cows.

The temperature of the milk was reduced to within 2 degrees of the temperature of the water passing through the cooler. The style of cooler is shown in Plate V. From this point the milk was conveyed to the milk house or bottling room when convenient, as the low temperature of the milk would permit holding it without danger of increasing the bacteria.

Sanitary bottling room.—Too much money was expended for a so-called bottling room which was insulated and provided with double windows which could not be opened. There being no intake for fresh air for fear of contaminating the room, when the ventilating system did not work, the room was hot and damp. It is only necessary to keep a room closed during the process of bottling, hence expensive insulation and double windows are unnecessary. An ordinary cement or plastered room, kept clean and with the floor moistened before bottling, will answer all purposes, provided the milk is not exposed in the room, which it need not be.

Bottling.—The bottles into which the milk was put were sterilized and the milk was bottled as quickly as possible; the filled bottles were covered with crushed ice until delivered to the consumers.

Analyses of product.—The following bacteria counts of the milk supplied by the dairy just described have been reported. They are certified to by Dr. F. F. Wesbrook, director of the laboratories of the Minnesota State Board of Health, and A. P. McDaniel, assistant bacteriologist. The tests were made with milk thirty-six hours old taken from delivery wagons.

Date.	Colonies.	Date.	Colonies.
	Per c. c.		*Per c. c.*
January 8	650	March 30	900
January 15	1,200	April 6	2,000
January 20	2,500	April 6	700
January 20	800	April 13	4,000
January 29	2,900	April 19	1,200
January 31	2,900	April 26	145
February 10	1,500	May 13	480
February 12	1,600	May 25	500
February 17	1,500	May 25	2,100
February 26	700	June 2	570
February 26	1,800	June 10	1,900
March 18	2,800	June 16	420
March 23	500	June 21	1,400
March 24	600	June 23	850

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